

# Planning

The planning step involves getting everyone who will be doing the work activity and other experts to sit down and discuss the flow of the activity. This step will also involve reading and preparing any related Standard Operating Procedures (SOPs), Safety Data Sheet (SDS) and Safe Work Procedures (SWPs).

Communication is important here and everyone involved should fully understand the flow of the work process. Brainstorming and feedback from all personnel involved are important and should be discussed at this stage.



# Hazard Identification

After listing down every step of the work activity, the team will then identify the potential hazards (any thing, situation, condition with the potential to cause harm) in each steps. Some examples of hazards are listed in the table below:

Hazard	Sub-Hazard
Biological	<ul style="list-style-type: none"><li>• Contact with or infection by bacteria, virus or fungal spores</li><li>• Release of biological agents to environment</li></ul>
Chemical	<ul style="list-style-type: none"><li>• Toxic</li><li>• Corrosive</li></ul>
Ergonomic	<ul style="list-style-type: none"><li>• Repetitive movement</li><li>• Awkward position</li></ul>
Physical	<ul style="list-style-type: none"><li>• Noise</li><li>• Slips, trips and falls</li></ul>
Electrical	<ul style="list-style-type: none"><li>• Electrocutation</li><li>• Electrical fires</li></ul>
Mechanical	<ul style="list-style-type: none"><li>• Strike by moving objects</li><li>• Caught in between equipment</li></ul>
Psychosocial	<ul style="list-style-type: none"><li>• Stress</li><li>• Fatigue</li></ul>
External	<ul style="list-style-type: none"><li>• Earthquakes</li><li>• Volcanoes</li></ul>

# Risk Evaluation

After identifying all the hazards, the next step is to conduct risk analysis to understand the consequences of exposures and to define the severity and probability for each hazard.

## Severity Table

The severity table describes the severity of hazard. The following table help to give a idea of how to define the severity accordingly to NTU.

Severity Index	Severity Description	Workplace Safety	Workplace Health	Environment	Fire Damage	Downtime Incurred
1	Critical	Fatality or permanent loss of limbs / speech etc.	Infection / acute poisoning with no cure	Spills to outside campus	More than \$10 million damage	More than 1 year for full re-installment
2	Very Serious	Injury requiring more than 30 days of medical leave	Infection / exposure with known cure but require extensive treatment	Spills to outside building	More than \$1 million damage	More than 3 months for full re-installment
3	Serious	Injury requiring more than 10 days of medical leave	Infection / exposure with known cure but requires prolong treatment	Spills to other laboratories within the same level	More than \$100k damages	More than 1 month for full re-installment
4	Marginal	Injury requiring maximum 3 days of medical leave	Infection / exposure with known cure but treatment needed	Spills confined to the laboratory only	More than \$10k damages	More than a week for full-re-installment

# Risk Evaluation

## Likelihood Table

The likelihood is the probability (frequency) of being affected by the hazards. It can be changed depending on the existing risk control measures (e.g. likelihood of slips, trips and falls will be reduced if there are signs to warn of the dangers of wet floor)

Likelihood Index	Likelihood Description	Likelihood of Occurrence / Exposure Criteria
5	Frequent	Likely to occur many times per year
4	Moderate	Likely to occur once per year
3	Occasional	Might occur once in three years
2	Remote	Might occur once in five years
1	Unlikely	Might occur once in ten years

# Risk Evaluation

## Risk Matrix Table

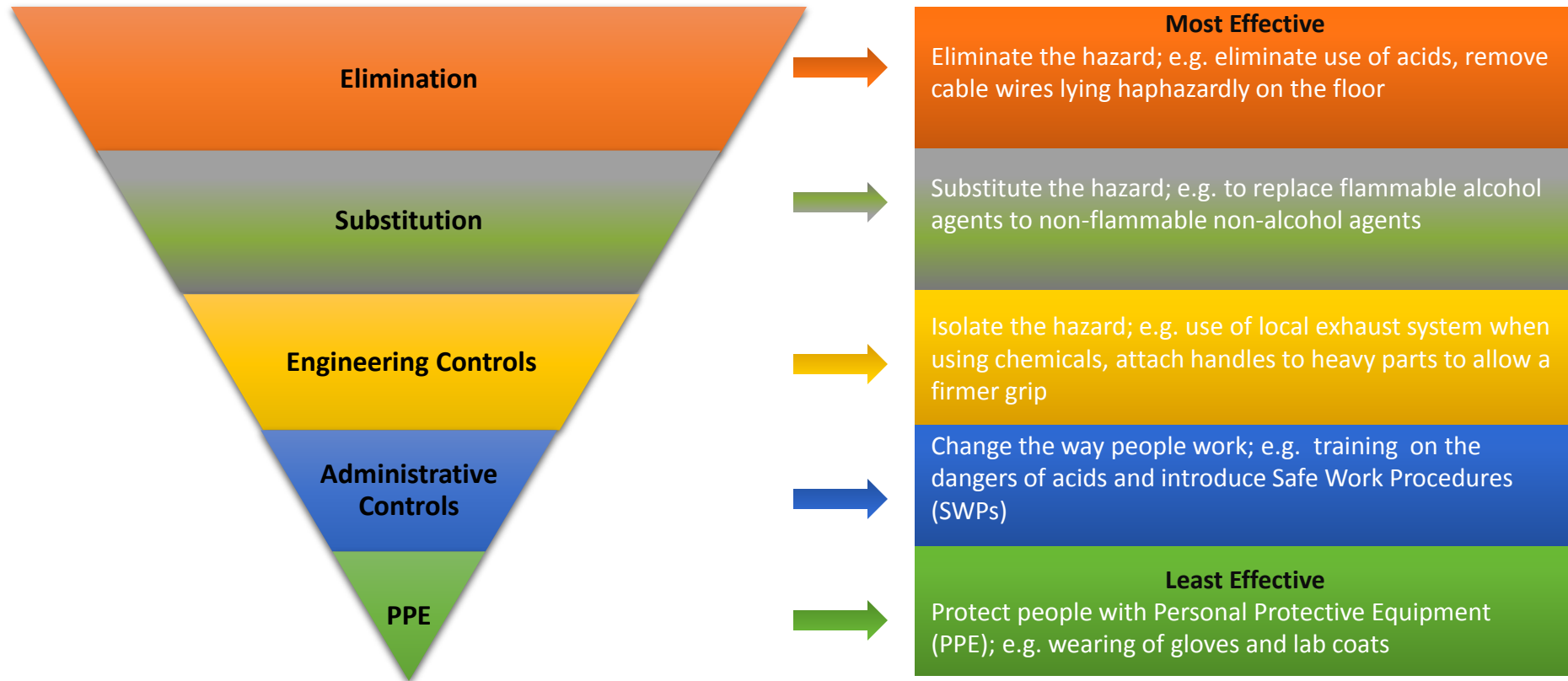
The Risk Matrix Table shows the Risk Prioritization Number (RPN) which is obtained by multiplying the Severity and Likelihood. For risks with RPN of more than 16, the work activity should not be continued until it is reduced. For risks with RPN of between 8 – 15, additional control measures should be in-place to reduce RPN to 8 and below.

Severity \ Likelihood	Critical (5)	Very Serious (4)	Serious (3)	Marginal (2)	Negligible (1)
Frequent (5)	25 Operation not permissible	20 Operation not permissible	15 High priority	10 Review at appropriate time	5 Risk acceptable:
Moderate (4)	20 Operation not permissible	16 Operation not permissible	12 High priority	8 Review at appropriate time	4 Risk acceptable:
Occasional (3)	15 High priority	12 High priority	9 Review at appropriate time	6 Risk acceptable:	3 Risk acceptable:
Remote (2)	10 Review at appropriate time	8 Review at appropriate time	6 Risk acceptable:	4 Risk acceptable	2 Risk acceptable:
Unlikely (1)	5 Risk acceptable:	4 Risk acceptable:	3 Risk acceptable:	2 Risk acceptable:	1 Risk acceptable:

# Risk Control

Risk controls are measure implement to reduce the severity and / or and the likelihood of the hazards. There are many different types of risk control and they are generally divided into 5 board types.

The diagram below shows the hierarchy of risk controls:



# Record Keeping

After completing the risk analysis and introducing risk control measures processes, all communication should be documented and the RA should be sent for approval by the Person-in-Charge (PIC). The person (s) conducting the RA should not also be the approver.

All documents are then to be communicated to the rest of the team and to kept for six years. These records serve as evidence to demonstrate in providing a healthy and safe workplace and are legally required if accidents were to happen.



# Implementation and Review

After approval, the risk control measures must be implemented by responsible person (s). In addition, the control measures should also be regularly maintained and tested if needed (e.g. fumehoods and safety valves).

All implementation should be communicated and all feedback on the control measures should be noted and documented. It is also important to review and evaluate the control measures to measure their effectiveness.

Some examples of evaluation tools used in measuring the effectiveness of control measures are:

- Feedback
- Inspections and observations
- Interview and discussions

If there is a need, the RA should be reviewed and redo if the control measures are found not to be effective.